

09/600208

AMENDMENT AND RESPONSE

February 7, 2002

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38. (Amended) An optical arrangement in an illumination beam path of a confocal laser microscope, said optical arrangement comprising: an illumination optical system arranged in said illumination beam path for modifying an illumination diameter of an illumination beam of said microscope, wherein the illumination optical system is a zoom optical system which operates steplessly; and an additional input whereby a laser light beam from a further light source can be coupled in to said illumination beam path via said additional input and is adaptable to an entry pupil of an objective of said microscope with no adaptation of the actual illumination beam path.

REMARKS

*Drawings*

The objections to the drawings are respectfully overcome by submission of the proposed new drawing sheets containing additional Figs. 4 and 5. These figures do not contain new matter. The BRIEF DESCRIPTION OF THE DRAWINGS has been amended to include description of new Figs. 4 and 5.

Regarding the use of an optical component for altering an intensity distribution of the illumination beam (claim 34), Fig. 4 shows an optical component 17 in the illumination beam path for this purpose. As mentioned in the specification as amended, optical component 17 can be a lens, an annular stop, or a holographically generated optical element (claims 35-37).

Claim 24 states "wherein said microscope includes a plurality of predefined objectives selectively positionable in said illumination beam path ...". It is respectfully urged that this structure is extremely old and well-known in the field of microscopes because most microscopes have an objective turret that rotates to allow a different magnification objective to be positioned in the illumination beam path. Therefore, withdrawal of the objection as to this structure is kindly asked.

The features of Claim 38 are shown in newly added Fig. 5, which shows a further light source 19 and a beamsplitter 18 as an input for coupling in the laser beam from source 19.

For the above reasons, it is respectfully asked that the examiner reconsider and remove the drawing objections set forth in the Office Action.

### *Specification*

The specification is objected to for various informalities mentioned in the Office Action. It is hoped that the explanations provided below will allow the Examiner to withdraw the objection.

Page 3, lines 21-23 of the specification read as follows: "The illumination optical system could be embodied as a parallelizing optical system with a fixed focal intercept but variable focal length, the beam diameter being adaptable to the entry pupil of the objective." This passage merely describes a zoom lens system whereby the beam diameter of the illumination beam can be changed to correspond to the entry pupil of the objective. It is noted that the term "focal intercept" and "focal length" do not have the same meaning, such that the "focal intercept" of a system can be fixed and the "focal length" of a system can be variable.

Page 3, lines 26-29 of the specification read as follows: "It is also conceivable for the illumination optical system to be embodied as an expanding optical system for a preferably directly coupled-in laser beam. In this context the beam could be variably expandable in accordance with the ratio  $f_1/f_2$  of the focal lengths." This passage refers to a beam expander, a well-known optical arrangement. Enclosed is a sketch illustrating a beam expander and focal lengths  $f_1$  and  $f_2$  associated therewith. As is well understood by those skilled in the art,  $D_2 = D_1 \times f_1/f_2$ . Thus, the passage has clear meaning persons skilled in the art.

The paragraph starting at page 4, line 27 of the specification has been amended to remove the reference to the claims at lines 28-29 as suggested by the Examiner.

Based on the foregoing, Applicants respectfully request reconsideration of the specification and withdrawal of the objections stated in the Office Action.

### *Claim Objections*

Claim 38 has been placed in independent form and includes all of the limitations of amended Claim 17. Favorable reconsideration and withdrawal of the objection to Claim 38 is requested.

***Claim Rejections - 35 USC § 112***

Claims 24-25, 30, and 34-38 are rejected under 35 USC § 112, second paragraph, as being indefinite. The rejection is respectfully traversed in part and overcome by amendment in part.

Regarding Claims 24 and 25, it is respectfully argued that these claims are clear and definite, and that Claim 24 merely places a further limitation on the function of the illumination optical system set forth in Claim 17. The function of the "illumination optical system" as stated in Claim 17 is "for modifying an illumination diameter of an illumination beam of said microscope." In Claim 24, this modifying function is further limited by claiming that the illumination optical system "modifies said illumination diameter to match the entry pupil of a selected one of said plurality of objectives." Accordingly, Claim 24 and its dependent claims 34-37, like Claim 17, are in a permissible means plus function format. It is kindly asked that the Examiner reconsider this rejection.

Regarding the manner in which the stated function is accomplished, the Examiner is referred to page 2, line 28 - page 3, line 17, and page 6, lines 18-20 of the specification. Essentially, the function could be accomplished with replaceable fixed optics in the beam path, wherein an assortment of fixed optics are provided corresponding to different microscope objectives. Regarding automatic adjustment according to Claim 25, a motorized zoom system is described. As mentioned at page 3, lines 12-17 of the specification, various automatic zoom lens settings are matched to the rotational positions of the objective turret (nosepiece).

Claim 30 is respectfully thought to be clear, and the Examiner is referred to the portion of this Response above dealing with the objection to page 3, lines 21-23 specification for an explanation.

The lack of antecedent basis in Claim 38 has been cured by amendment of Claim 38. The phrase "is adaptable to an entry pupil of an objective of said microscope with no adaptation of the actual illumination beam path" simply means that no change in the microscope's illumination beam path is required to adapt the coupled in laser light to the entry pupil of the objective.

For the reasons given above, it is respectfully requested that the rejections under 35 USC 112 be removed.

***Claim Rejections - 35 USC § 102***

Claims 17, 19-21, 24-25, 30, 32-33 and 39 are rejected under 35 USC § 102 as being anticipated by US 5,184,012 (Yamamoto). Independent Claim 17 has been amended to include the limitations of Claims 19-21, which claims have been cancelled. It is respectfully argued, for the reasons presented below, that amended Claim 17 is not anticipated by Yamamoto.

Claim 17, as amended, requires that "the illumination optical system is a zoom optical system which operates steplessly." A "zoom optical system" is an optical system of variable focal length, with the focal plane remaining in a fixed position. See, for example, "The Photonics Dictionary" at <http://www.photonics.com/dictionary/>. In the case of a confocal laser microscope, there is necessarily a point source of light (reference numeral 2 in Fig. 1). In accordance with the present invention, the point source 2 can be thought of as residing in a fixed focal plane of the claimed zoom optical system (represented by movable lens 16). As the focal length of the zoom optical system is varied, the focal plane (and focal intercept) of the zoom optical system remains at the point source 2. As a result, the diameter of the illumination beam is modified without destroying the confocal imaging function of the microscope.

By contrast, Yamamoto teaches the insertion of a beam diameter changing system 30 that receives an incident parallel beam as input and delivers a parallel beam of different diameter as output. The beam diameter changing system of Yamamoto (including lenses 41, 43, 42, and 44), ***taken as a system***, is not a zoom optical system, but rather an afocal beam expander system. If one were to substitute the beam diameter changing system of Yamamoto for the zoom optical system in a divergent illumination beam of a confocal laser microscope as taught by the present invention, the confocal imaging function of the microscope would not be maintained. Yamamoto does not teach or suggest the use of a zoom optical system for modifying an illumination diameter of an illumination beam in a confocal laser microscope. Indeed, Yamamoto does not address the special problem of confocal imaging.

On this basis, it is respectfully urged that amended Claim 17, and Claims 24-25, 30, 32-33 and 39 depending therefrom, are not anticipated by Yamamoto. Favorable reconsideration is respectfully requested.

***Claim Rejections - 35 USC § 103***

Claims 22-23 are rejected under 35 USC § 103 as being unpatentable over Yamamoto in view of US 5,140,458 (Takagi et al.). The rejection is respectfully considered to be overcome in light of the amendment of Claim 17, from which Claims 22-23 now depend, and based on the failure of Yamamoto to teach or suggest a zoom optical system as discussed above. Withdrawal of the rejection is earnestly sought.

Claims 28-29 are rejected under 35 USC § 103 as being unpatentable over Yamamoto with or without US 5,054,926 (Dabbs et al.). The rejection is respectfully considered to be overcome in light of the amendment of Claim 17, from which Claims 28-29 now depend, and based on the failure of Yamamoto to teach or suggest a zoom optical system as discussed above. It is also noted that it is well established that a point source is critical for confocal imaging in a confocal laser microscope. Applicants respectfully seek removal of this rejection.

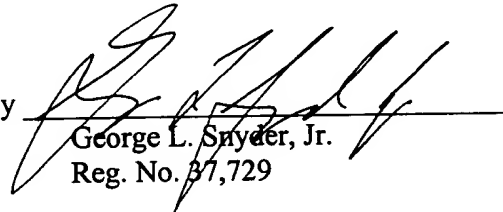
Claims 34-36 are rejected under 35 USC § 103 as being unpatentable over Yamamoto in view of US 4,530,578 (Kato). The rejection is respectfully considered to be overcome in light of the amendment of Claim 17, from which Claims 34-36 depend, and based on the failure of Yamamoto to teach or suggest a zoom optical system as discussed above. The Kato patent discloses the use of a negative lens 20 after a fiber optic source 1 and aperture stop 2 in an illumination beam path of a "variable magnification observation apparatus" to increase illumination intensity near an edge of the illumination beam. The reference does not suggest using an annular stop (Claim 36) for this purpose. Applicants respectfully ask that the rejection be withdrawn.

***Conclusion***

For the foregoing reasons and by virtue of the amendments presented herein, the present application is now thought to be in a condition for allowance, which action is courteously requested. If the examiner has any questions, the undersigned attorney of record may be contact at the new number (716) 856-4000 as indicated on the Change of Correspondence Address form provided herewith.

Respectfully submitted,

By

  
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
PATENT COOPERATION TREATY

Applicant(s): Johann ENGELHARDT et al.

Atty Ref: 293.000218

Serial No.: 09/600208

Group Art Unit: 2872

Filing Date: 12-Jul-2000

Examiner: T. Nguyen

Title: OPTICAL ARRANGEMENT IN THE ILLUMINATION BEAM PATH OF A  
MICROSCOPE

CERTIFICATION UNDER 37 C.F.R. 1.8

I hereby certify that this Marked version of Specification Amendments is being deposited with the United States Postal Service as first class mail on February 7, 2002 in an envelope addressed to: Box Non-Fee Amendment, Commissioner for Patents, Washington, D.C. 20231.

George L. Snyder, Jr.

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MARKED VERSION OF SPECIFICATION AMENDMENTS

Box Non-Fee Amendment  
Commissioner for Patents  
Washington, D.C. 20231

Honorable Sir:

The specification is amended as follows:

In accordance with 37 CFR 1.121(b)(1), the paragraph beginning at page 4, line 27, is replaced by the following amended paragraph:

--There are various ways of advantageously embodying and developing the teaching of the present invention. Reference is made, for that purpose, [on the one hand to the claims, and on the other hand] to the explanation below of [three] several exemplary embodiments of the invention with reference to the drawings. In conjunction with the explanation of the preferred exemplary embodiments of the invention, a general explanation is also given of preferred embodiments and developments of the teaching.--

In accordance with 37 CFR 1.121(b)(2), the section "BRIEF DESCRIPTION OF THE DRAWINGS" is replaced by the following replacement section:

--BRIEF DESCRIPTION OF THE DRAWINGS

The subject matter of the invention is described with reference to the embodiments shown in the drawings.

Fig 1 shows, in a schematic depiction, a first exemplary embodiment of an optical arrangement according to the present invention in the beam path of a confocal scanning microscope, a point light source being provided as the light source and the scanning microscope being depicted, for the sake of simplicity, merely schematically by way of its components;

Fig. 2 shows, in a schematic depiction, a second exemplary embodiment of an optical arrangement according to the present invention in the beam path of a confocal scanning microscope, an optical fiber being provided as the light source and the scanning microscope being depicted, for the sake of simplicity, merely schematically by way of its components; [and]

Fig. 3 shows, in a schematic depiction, a third exemplary embodiment of an optical arrangement according to the present invention in the beam path of a confocal scanning microscope, a laser light source or laser beam being provided as the light source and the scanning microscope being depicted, for the sake of simplicity, merely schematically by way of its components;

Fig. 4 shows, in a schematic depiction, another exemplary embodiment generally similar to that shown in Fig. 1 but further including an optical component in the illumination beam path for altering an intensity distribution of the illumination beam; and

Fig. 5 shows, in a schematic depiction, another exemplary embodiment generally similar to that shown in Fig. 3, wherein a laser light beam from a further laser light source is



coupled into the illumination beam path.--

In accordance with 37 CFR 1.121(b)(1), the following two paragraphs are added by inserting them at page 6, line 25 (blank line) of the specification:

-- Fig. 4 shows an arrangement according to the present invention wherein the illumination optical system comprises a further optical component 17 in the illumination beam path that influences or favors edge illumination. Optical component 17 can be an additional lens, an annular stop, or a holographically generated optical element, the principal result thereof being that the ordinarily Gaussian intensity distribution of the laser beam is expanded in the edge regions. For example it would be possible thereby, especially in the case of confocal laser scanning microscopy, to achieve a constant intensity distribution over the entire entry pupil without causing substantial overillumination of the entry pupil of the objective. An intensity profile deviating therefrom may also be advantageous for a specific application.

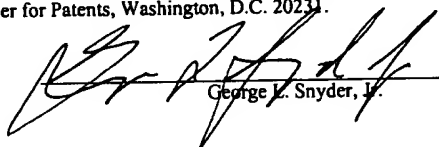
Fig. 5 shows an arrangement according to the present invention having an additional beamsplitter input 18 for feeding in a further light source 19, preferably providing a laser light beam. With no modification of the actual illumination beam path, this laser light beam could be adaptable to the entry pupil of the objective, thus also making possible in this context an optimization of the laser light beam with no adaptation of the actual illumination beam path.--

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
PATENT COOPERATION TREATY**

Applicant(s): Johann ENGELHARDT et al. Atty Ref: 293.000218  
Serial No.: 09/600208 Group Art Unit: 2872  
Filing Date: 12-Jul-2000 Examiner: T. Nguyen  
Title: OPTICAL ARRANGEMENT IN THE ILLUMINATION BEAM PATH OF A  
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CERTIFICATION UNDER 37 C.F.R. 1.8

I hereby certify that this marked version of Amended Claims is being deposited with the United States Postal Service as first class mail on February 7, 2002 in an envelope addressed to: Box Non-Fee Amendment, Commissioner for Patents, Washington, D.C. 20231.

  
George L. Snyder, Jr.

MARKED VERSION OF AMENDED CLAIMS

Box Non-Fee Amendment  
Commissioner for Patents  
Washington, D.C. 20231

Honorable Sir:

Claims 17, 22, 28, 29, 32, and 38 are amended as follows:

17. (Amended) An optical arrangement in an illumination beam path of a confocal laser microscope, said optical arrangement comprising an illumination optical system arranged in said illumination beam path for modifying an illumination diameter of an illumination beam of said microscope, wherein the illumination optical system is a zoom optical system which operates steplessly.

22. (Amended) The optical arrangement according to claim [21] 17, wherein said zoom optical system is motorized.

28. (Amended) The optical arrangement according to claim [19] 17, wherein said illumination optical system is arranged downstream from a point light source of said microscope.

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MARKED VERSION OF AMENDED CLAIMS

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29. (Amended) The optical arrangement according to claim [19] 17, wherein said illumination optical system is arranged downstream from an optical fiber light source of said microscope.

32. (Amended) The optical arrangement according to claim [19] 17, wherein said illumination optical system includes an expanding optical system for a coupled-in laser beam.

38. (Amended) [The optical arrangement according to claim 17,] An optical arrangement in an illumination beam path of a confocal laser microscope, said optical arrangement comprising: an illumination optical system arranged in said illumination beam path for modifying an illumination diameter of an illumination beam of said microscope, wherein the illumination optical system is a zoom optical system which operates steplessly; and an additional input [wherein] whereby a laser light beam from a further light source can be coupled in to said illumination beam path via [an] said additional input and is adaptable to [the] an entry pupil of [the] an objective of said microscope with no adaptation of the actual illumination beam path.